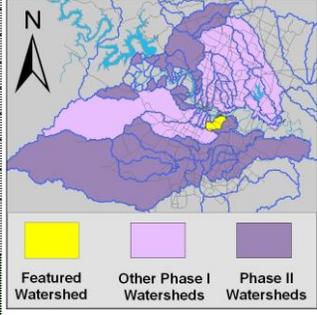


# Country Club Creek Watershed

## Summary Sheet

Catchment	Total area		5 square miles					
	Area in recharge		none					
	Creek length		7 miles					
	Receiving water		Colorado River					
Demographics	2000 population		14,620					
	2030 projected population		15,903					
	30 year projected % increase		9 %					
Land Use	Impervious cover (2003 estimate)		East 19.0 %		West 30.5%			
	Impervious cover (2013 estimate)		East 26.5 %		West 45.3%			
Overall EII Scores	west 2000 east	west 2003 east	west 2006 east	west 2009 east	west 2011 east	west 2013 east		
	60	55	54	47	51	42	51	47
	47	25	65	54				



### Flow Regime\* for Sample Sites on Country Club East

Site	Site Name	2001		2003				2006				2009				2010		2011				2013							
		Feb WQ	Feb Bio	Feb WQ	Mar WQ	Mar Bio	May WQ	Sep WQ	Dec WQ	Feb WQ	May WQ	Jul Bio	Aug WQ	Nov WQ	Feb WQ	May WQ	May Bio	Oct WQ	Dec WQ	Dec WQ	Mar WQ	Jun WQ	Jun Bio	Sep WQ	Jan WQ	Apr WQ	May Bio	Jun WQ	Sep WQ
848	ds Grove	B	B	B	B	B	B	B	B																				
1475	ACC								B	n	n	n	B	n	n	n	n	B	n	n	n	n	n	n	n	n	n	n	n

### Flow Regime\* for Sample Sites on Country Club West

Site	Site Name	2001		2003				2006				2009				2010		2011				2013							
		Feb WQ	Feb Bio	Feb WQ	Mar WQ	Mar Bio	May WQ	Sep WQ	Dec WQ	Feb WQ	May WQ	Jul Bio	Aug WQ	Nov WQ	Feb WQ	May WQ	May Bio	Oct WQ	Dec WQ	Dec WQ	Mar WQ	Jun WQ	Jun Bio	Sep WQ	Jan WQ	Apr WQ	May Bio	Jun WQ	Sep WQ
850	E Oltorf	B	B	B	B	B	B	B	B	B	B	n	B	B	B		B	B	B	B	B	B	B	n	B	B	B	n	B
849	Crossing Plc																								B	n	n	n	n
1474	Kreig Field	B	B	B	B	B	B	B	n	n	n	n	n	n	n	n	n	n	B	n	n	n	n	n					

\* B = baseflow n = no flow S = storm flow blue = Samples were taken light blue = Samples were not taken blank = not visited

### Index scores\* for Country Club East sites by year

Reach	Site	Site Name	Year	Water Quality	Sediment t**	Contact Rec.	Non-Contact Rec.	Physical Integrity	Aquatic Life	Benthic subindex	Diatom subindex	Total EII Score
CCE1	848	East Country Club Creek ds of Grove Dr	2000		87		53	31	48	53	43	55
CCE1	848	East Country Club Creek ds of Grove Dr	2003	31	70	59	58	33	29	20	37	47
CCE1	1475	East Country Club @ ACC	2006	54	85	43	45	24				42
CCE1	1475	East Country Club @ ACC	2009	50	79	25	45	60	23	23		47
CCE1	1475	East Country Club @ ACC	2011				37	39				25
CCE1	1475	East Country Club @ ACC	2013		69		65	82				54

### Index scores\* for Country Club West sites by year

Reach	Site	Site Name	Year	Water Quality	Sediment t**	Contact Rec.	Non-Contact Rec.	Physical Integrity	Aquatic Life	Benthic subindex	Diatom subindex	Total EII Score
CCW1	1474	West Country Club @ Krieg Fields	2000	52	87	72	78	52	43	44	42	64
CCW2	850	West Country Club Creek @ East Oltorf	2000	54	87	73	71	28	22	29	14	56
CCW1	1474	West Country Club @ Krieg Fields	2003	50	70	57	81	57	49	35	63	61
CCW2	850	West Country Club Creek @ East Oltorf	2003	48	70	51	54	55	42	36	48	53
CCW1	1474	West Country Club @ Krieg Fields	2006		66		53	52				43
CCW2	850	West Country Club Creek @ East Oltorf	2006	58	66	39	78	59	46	41	51	58
CCW1	1474	West Country Club @ Krieg Fields	2009	55	69	29	58	53				44
CCW2	850	West Country Club Creek @ East Oltorf	2009	50	69	34	78	57	64	43	84	59
CCW1	1474	West Country Club @ Krieg Fields	2011				57	34				30
CCW2	850	West Country Club Creek @ East Oltorf	2011	56		42	74	58	54	34	73	57
CCW1	849	West Country Club Cr. @ Crossing Place	2013	69	75	83	58	45	62	44	79	65
CCW2	850	West Country Club Creek @ East Oltorf	2013	65	75	38	76	47	79	85	73	63

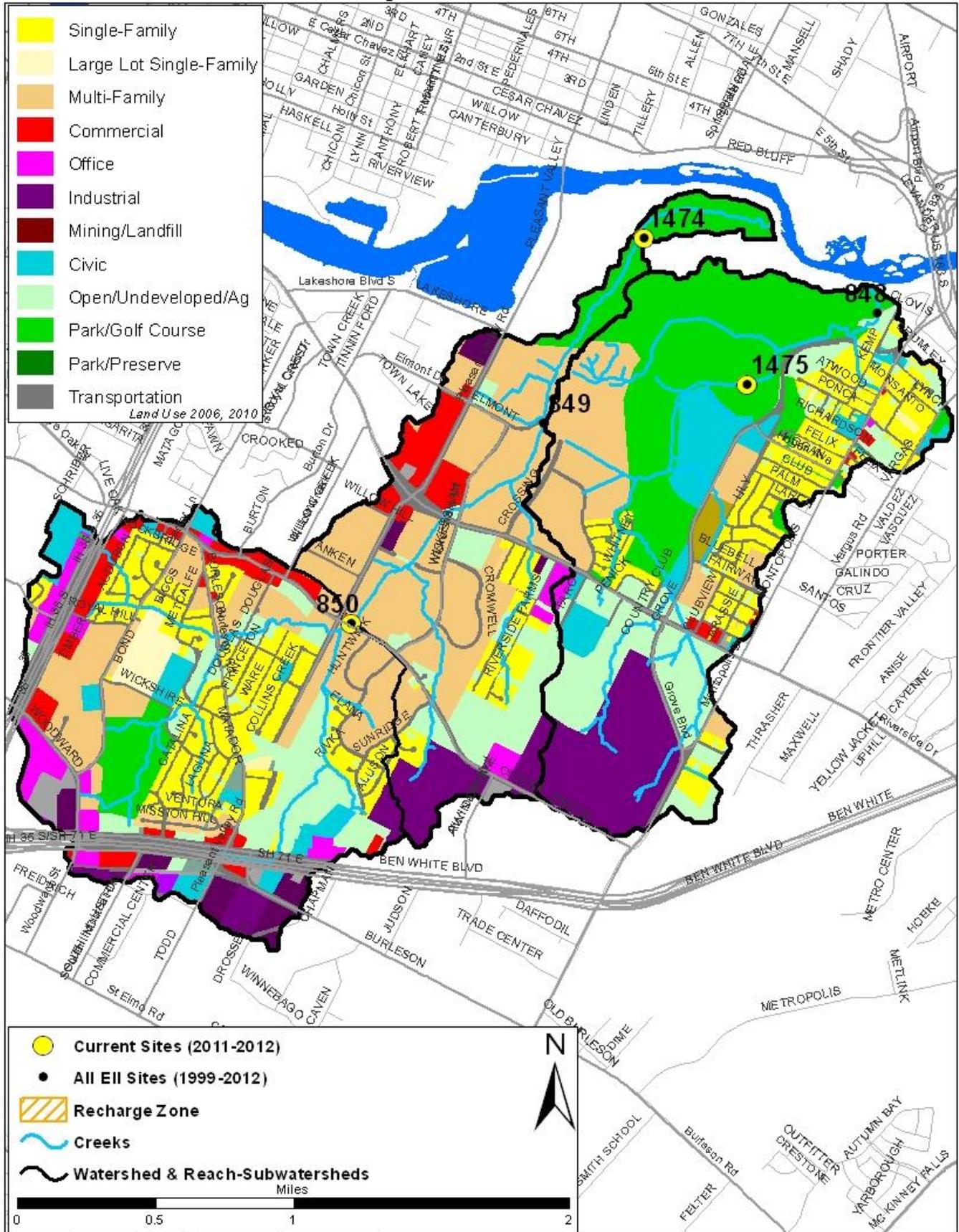
\* blank cells indicate parameter was not collected, blank row indicate site was dropped

\*\*sediment samples only collected at the downstream site

100-87.5 Excellent 87.5-75 V. Good 75-62.5 Good 62.5-50 Fair 50-37.5 Marginal 37.5-25 Poor 25-12.5 Bad 12.5-0 V. Bad

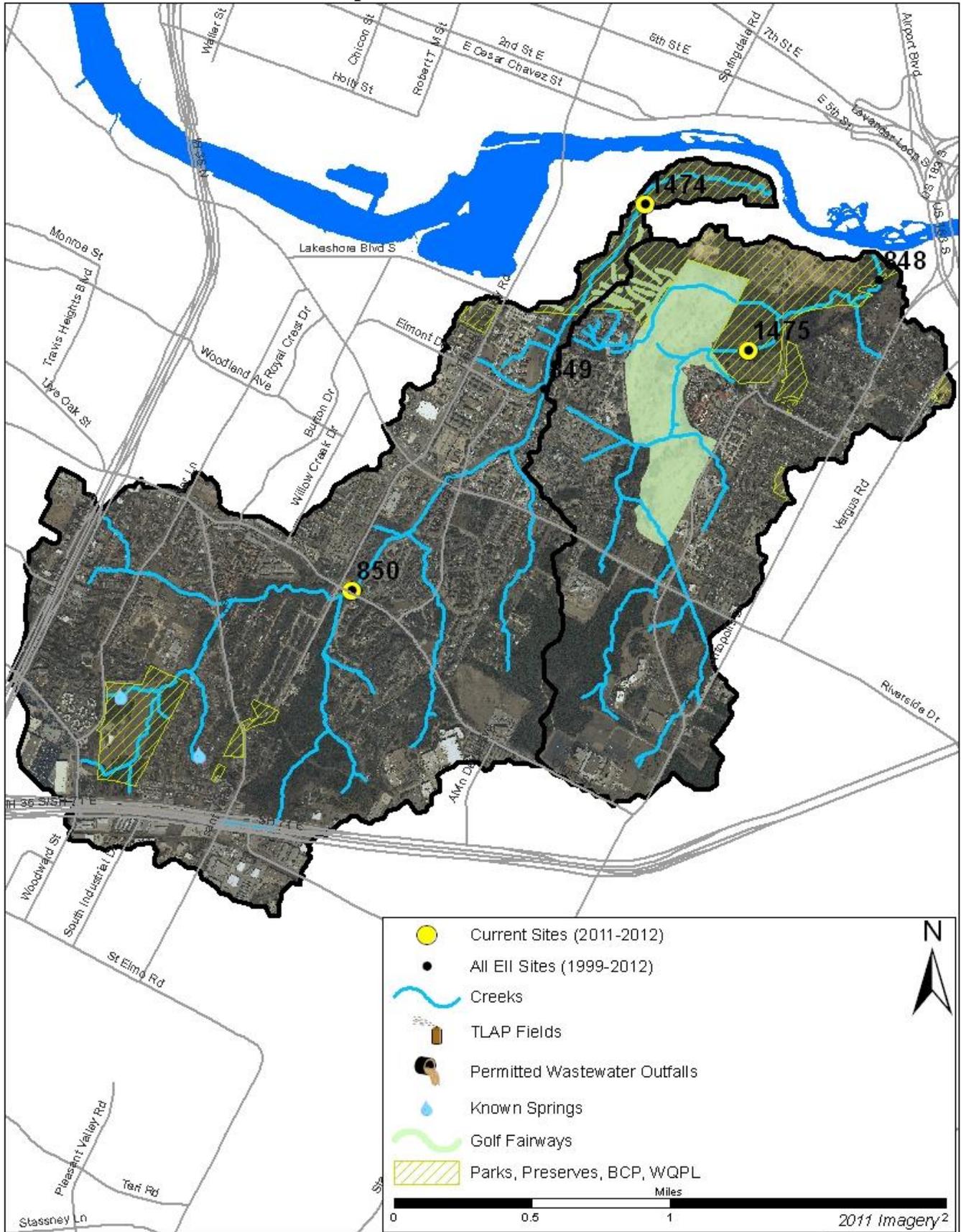
# Country Club Creek Watershed

## Land Use Map



# Country Club Creek Watershed

## Aerial Map



# Country Club Creek Watershed

## Water Quality Data – Temperature, Conductivity, pH, Dissolved Oxygen & E. coli for 2013 Sample Sites (Downstream to Upstream)

Qualifiers to the left of value:	>	greater than	Qualifiers to the right of value:	(blank)	Useable
	<	less than		S	Exceeds standard range
	< J	less than detection limit		R	Rejected, failed QC
	J	Estimated			

Site Name	Site #	Reach	Date	Temp.		Cond.		pH		D.O.		E.coli	
				<> Value	flag	<> Value	flag	<> Value	flag	<> Value	flag	<> Value	flag
West Country Club @ Crossing Place	849	CCW1	01/22/2013	13.2		726		7.87		10.1	R	27.9	
<b>Site 849 Mean</b>				<b>13.2</b>		<b>726</b>		<b>7.87</b>		<b>10.1</b>		<b>27.9</b>	
West Country Club @ E Oltorf	850	CCW2	01/22/2013	13.5		707		8.11		11.2	R	186.0	
West Country Club @ E Oltorf	850	CCW2	04/24/2013	18.1		616		8.12		10.6		325.5	
West Country Club @ E Oltorf	850	CCW2	09/26/2013	24.1		735		8.04		6.6		307.6	
<b>Site 850 Mean</b>				<b>18.6</b>		<b>686</b>		<b>8.09</b>		<b>9.5</b>		<b>273.0</b>	
<b>Watershed Mean</b>				<b>17.2</b>		<b>696</b>		<b>8.04</b>		<b>9.6</b>		<b>211.8</b>	

Orange highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

Summary Statistics for all 2013 – 2014 E.I.I. Sites Combined.					
Parameter	2013-2014 Average	2013-2014 Minimum	2013-2014 Maximum	1 Standard Deviation Above	1 Standard Deviation Below
Temperature (C°)	19.6	8.6	34.0	25.8	
Conductivity (uS/cm)	711	107	1783	942	
pH (Standard units)	7.86	6.96	8.97	8.19	7.52
D.O. (mg/l)	8.1	1.2	30.5	11.4	4.8
E.coli. (col/100ml)	435	1	4840	1127	

# Country Club Creek Watershed

## Water Quality Data – Ammonia, Nitrate / Nitrite, Ortho-Phosphorus, Total Suspended Solids & Turbidity for 2013 Sample Sites (Downstream to Upstream)

Qualifiers to the left of value:	>	greater than	Qualifiers to the right of value:	(blank)	Useable
	<	less than		S	Exceeds standard range
	< J	less than detection limit		R	Rejected, failed QC
	J	Estimated			

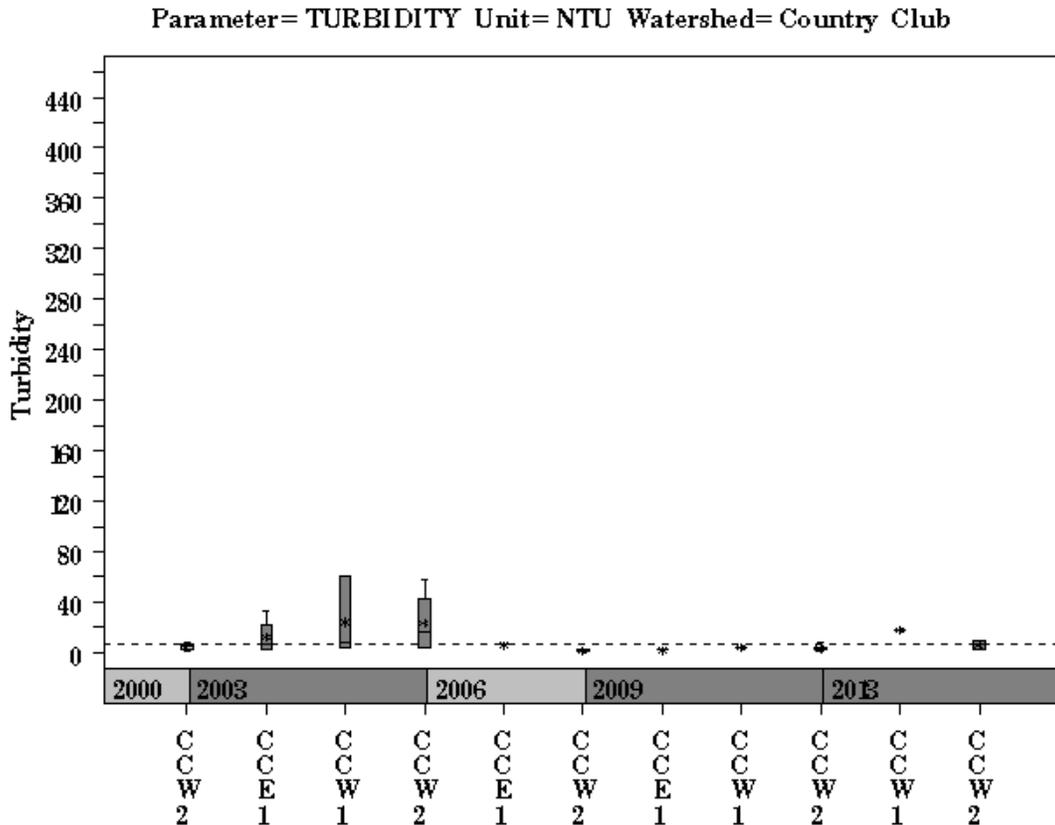
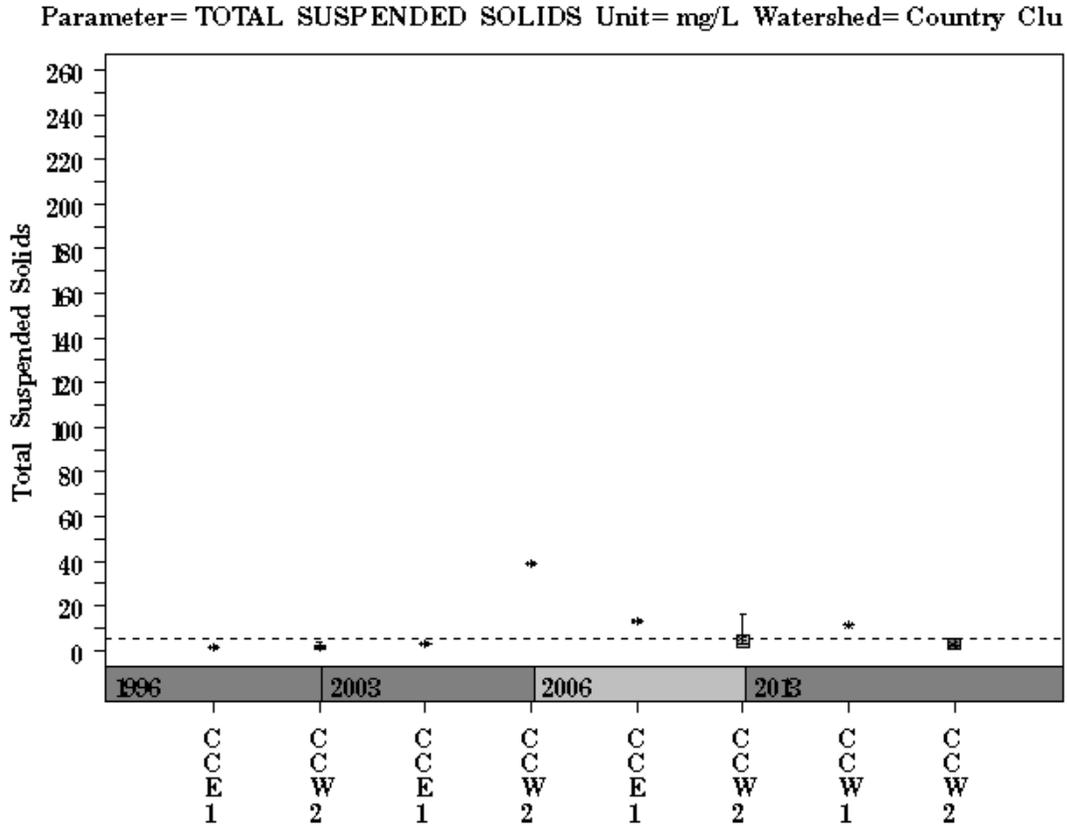
Site Name	Site #	Reach	Date	NH3-N		NO3/NO2		Ortho-P		T.S.S.		Turb.	
				<> Value	flag	<> Value	flag	<> Value	flag	<> Value	flag		
West Country Club @ Crossing	849	CCW1	01/22/2013	<J	0.008		0.03	<J	0.004		11.5		18.2
<b>Site 849 Mean</b>					0.008		0.03		0.004		11.5		18.2
West Country Club @ E Oltorf	850	CCW2	01/22/2013	J	0.012		0.16	<J	0.004	<J	1.0		2.0
West Country Club @ E Oltorf	850	CCW2	04/24/2013	<J	0.008	R	<J	0.01	<J	0.004		2.4	3.3 R
West Country Club @ E Oltorf	850	CCW2	09/26/2013		0.008		<J	0.01	<J	0.004		5.3	10.1
<b>Site 850 Mean</b>					0.009		0.06		0.004		2.9		5.2
<b>Watershed Mean</b>					0.009		0.05		0.004		5.0		8.4

Orange highlighting indicates that the value exceeds one standard deviation from the mean of all E.I.I. sites combined.

Summary Statistics for all 2013 – 2014 E.I.I. Sites Combined.				
Parameter	2013-2014 Mean	2013-2014 Minimum	2013-2014 Maximum	1 Standard Deviation Above
NH3-M (mg/l)	0.031	0.008	2.250	0.150
NO3-N (mg/l)	1.16	0.01	16.30	4.02
Ortho-P (mg/l)	0.041	0.004	1.360	0.164
TSS (mg/l)	5.6	1.0	70.0	15.3
Turbidity (NTU)	4.5	0.0	97.1	13.2

# Country Club Creek Watershed

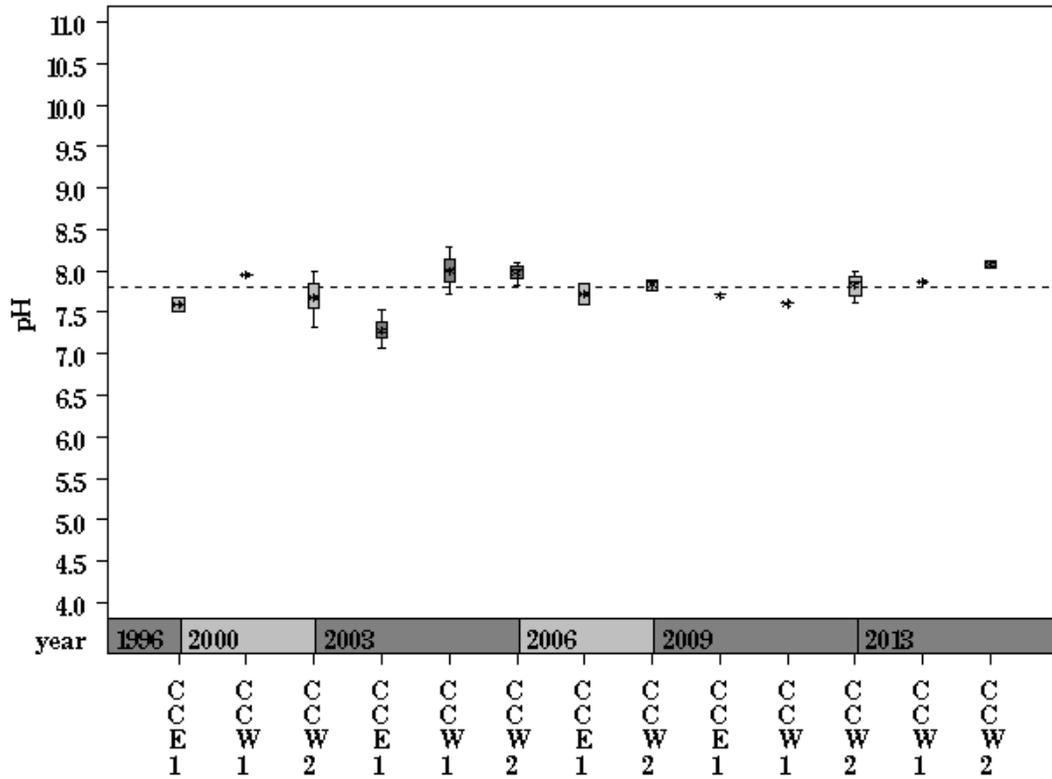
Data Summary Graphs – Total Suspended Solids and Turbidity (Downstream to Upstream by Year)



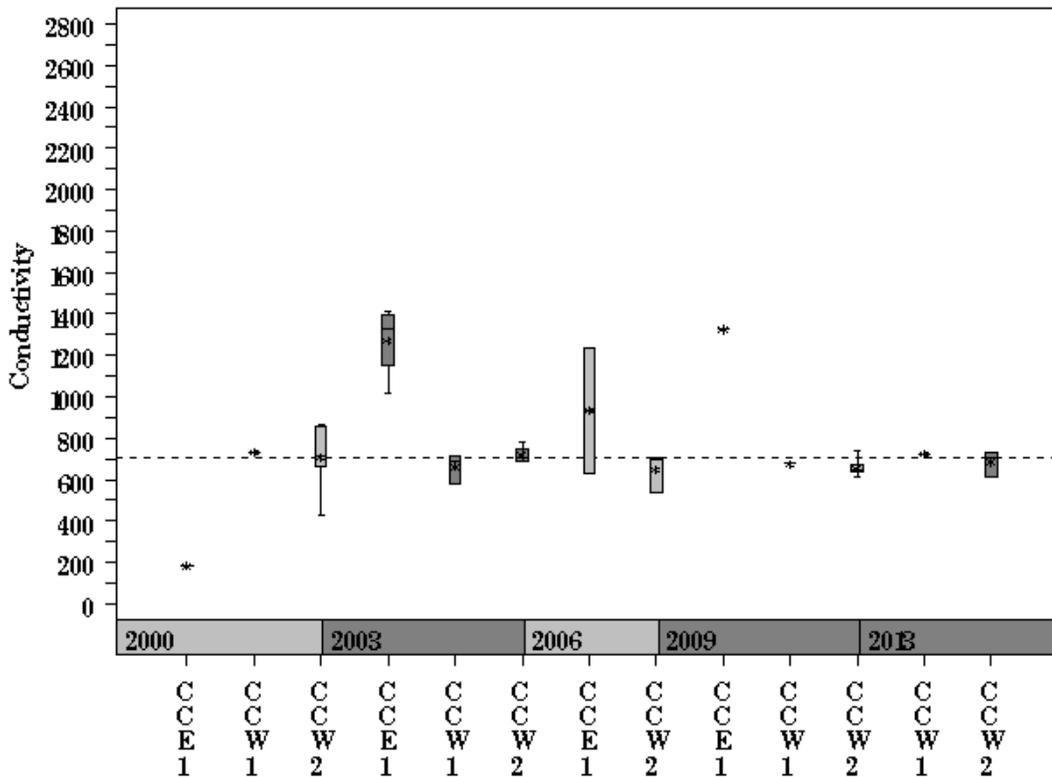
# Country Club Creek Watershed

Data Summary Graphs – pH and Conductivity (Downstream to Upstream by Year)

Parameter= PH Unit= Standard units Watershed= Country Club



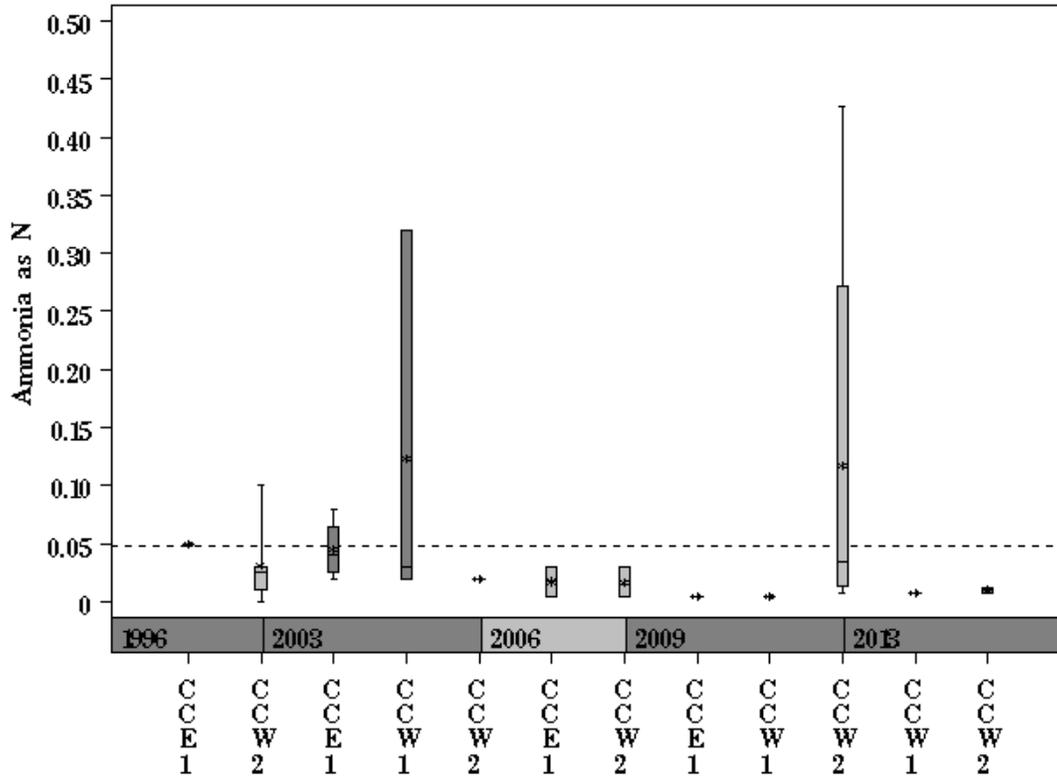
Parameter= CONDUCTIVITY Unit= uS/cm Watershed= Country Club



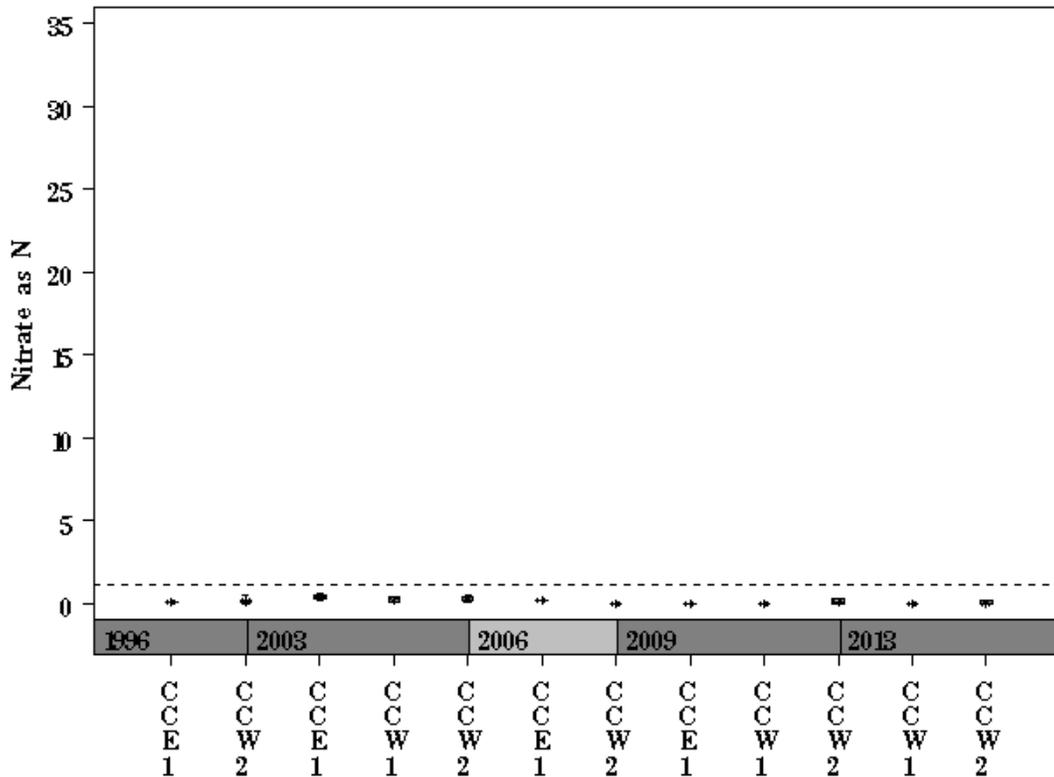
# Country Club Creek Watershed

Data Summary Graphs – Ammonia and Nitrate/Nitrite (Downstream to Upstream by Year)

Parameter= AMMONIA AS N Unit= mg/L Watershed= Country Club



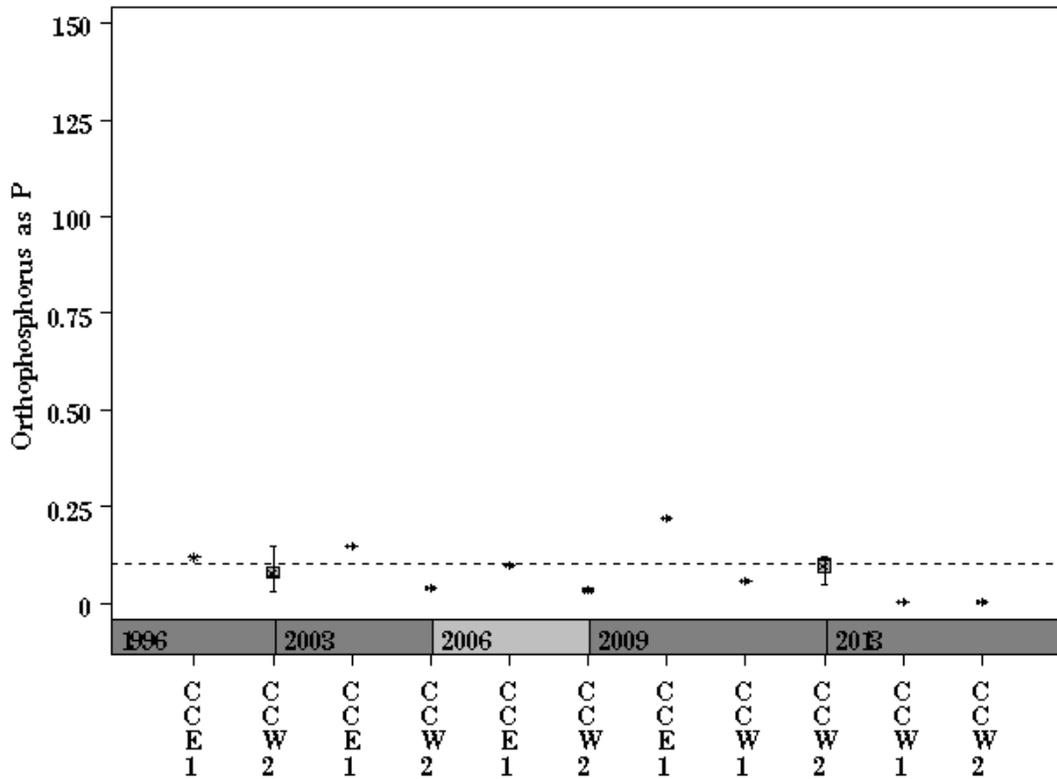
Parameter= NITRATE AS N Unit= mg/L Watershed= Country Club



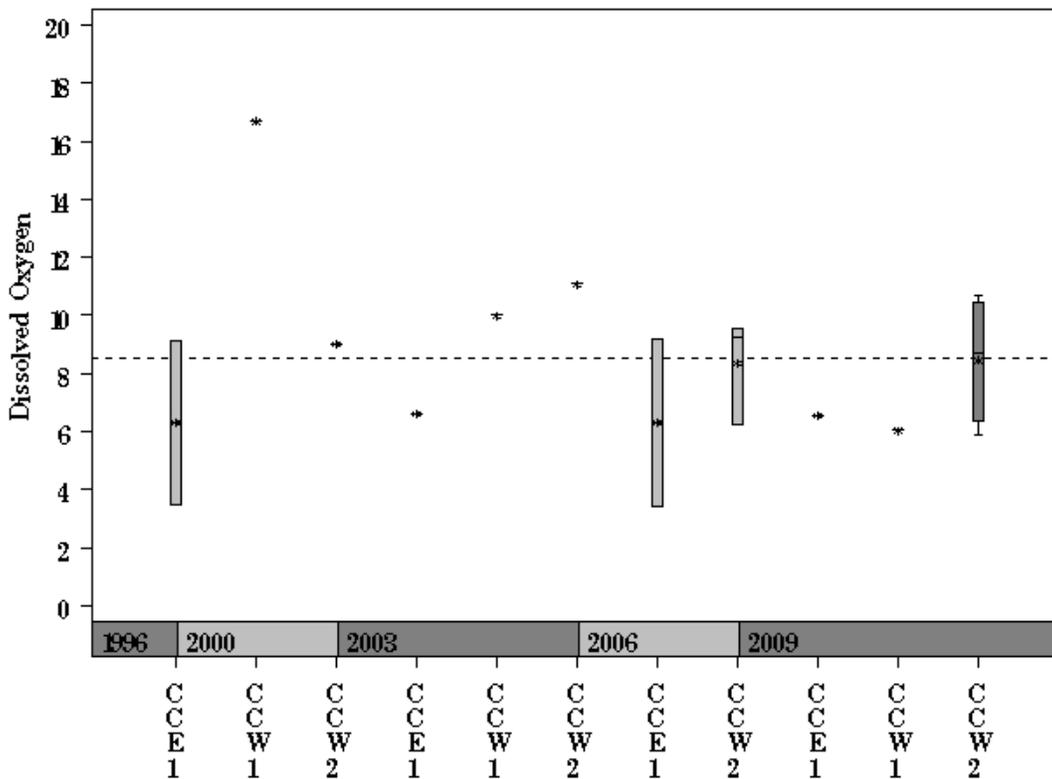
# Country Club Creek Watershed

Data Summary Graphs – Orthophosphate and Dissolved Oxygen (Downstream to Upstream by Year)

Parameter= ORTHOPHOSPHORUS AS P Unit= mg/L Watershed= Country Club

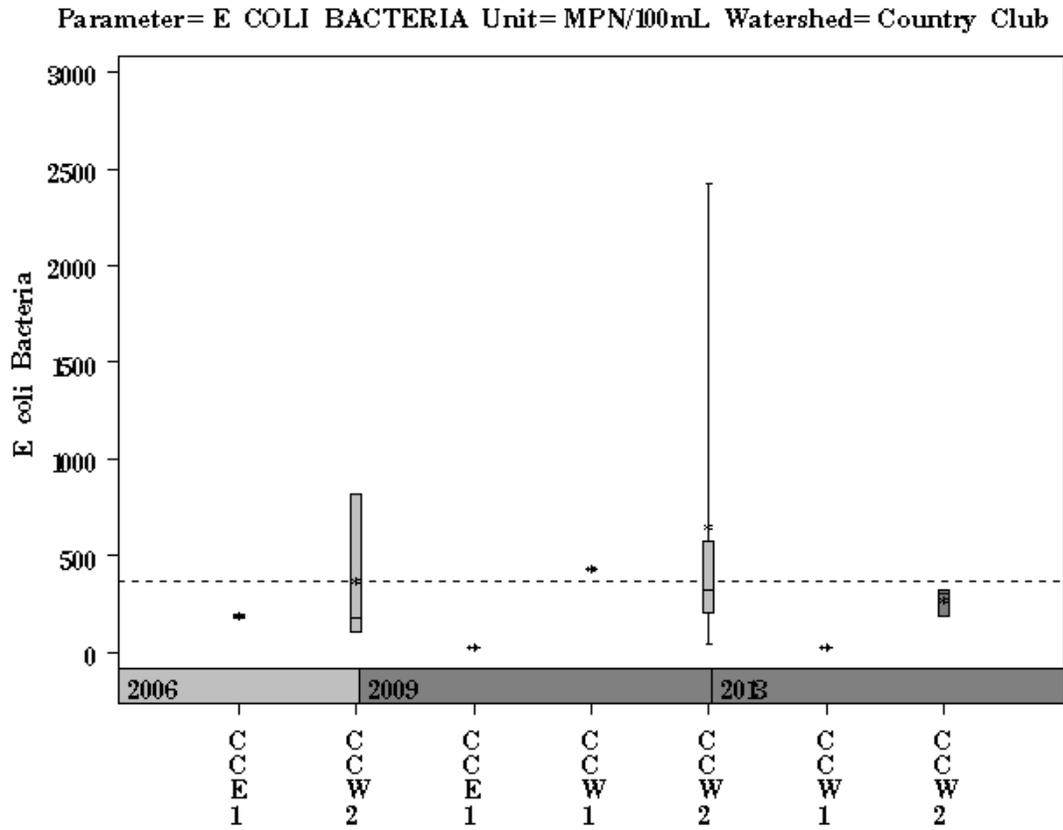


Parameter= DISSOLVED OXYGEN Unit= mg/L Watershed= Country Club



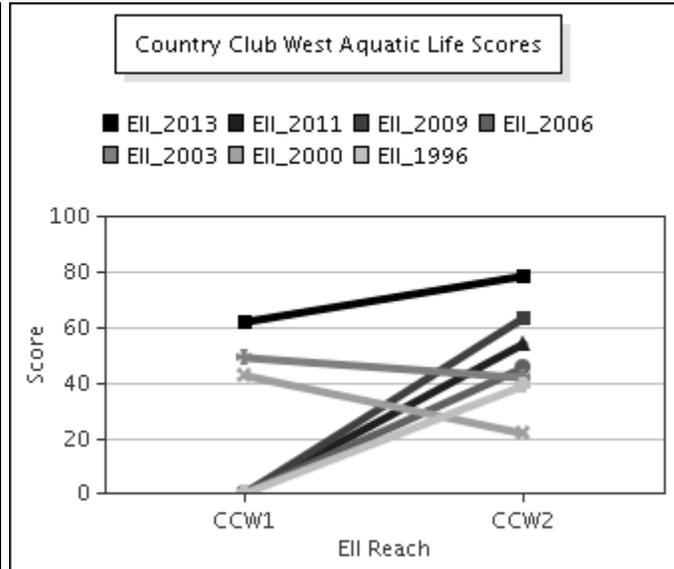
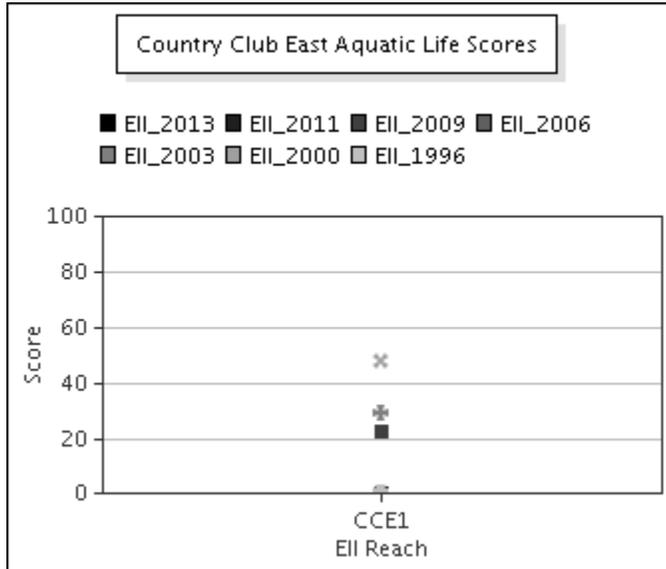
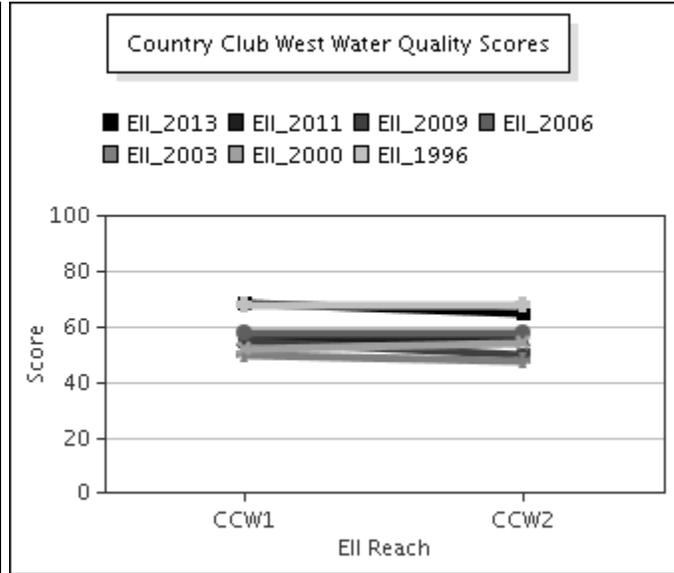
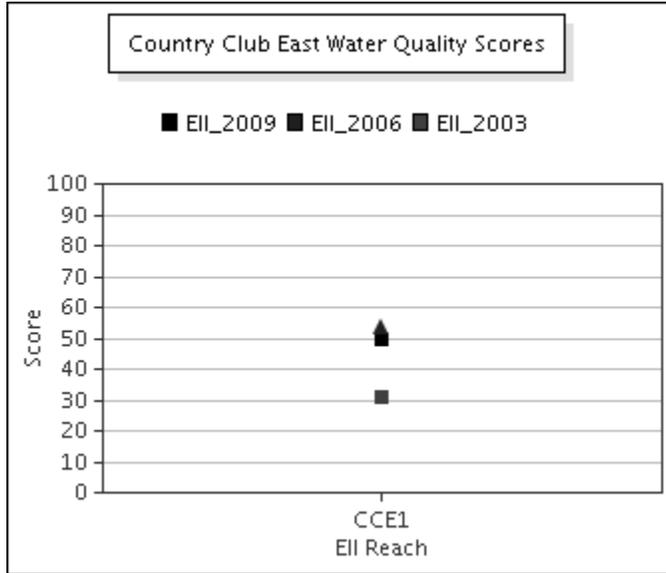
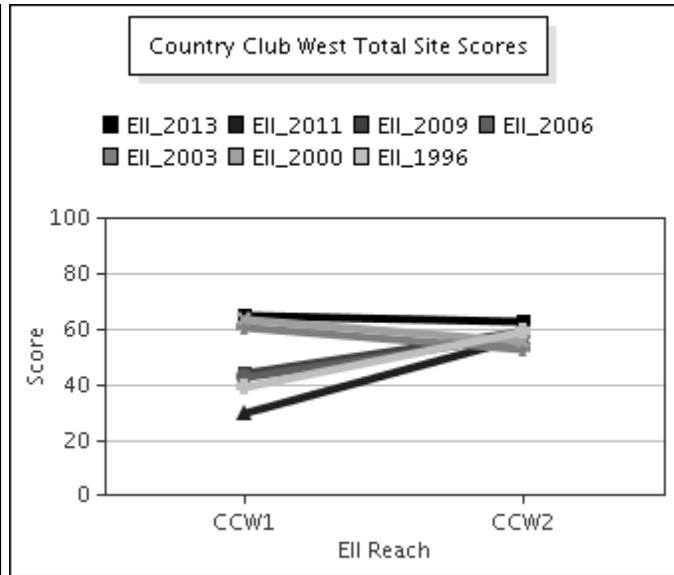
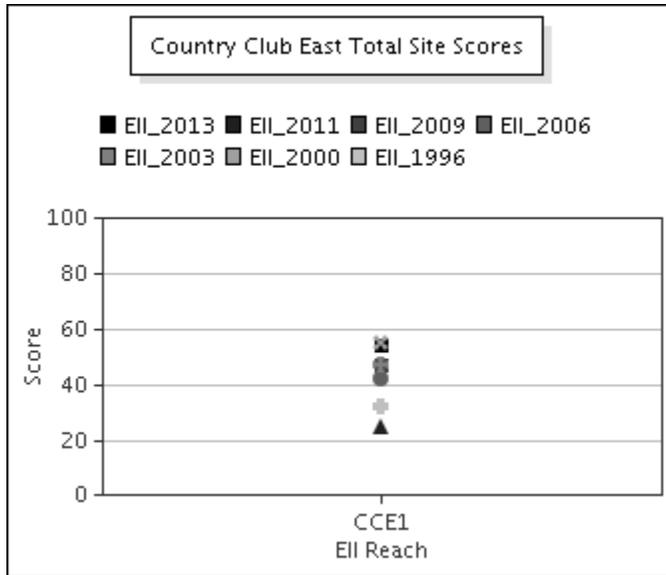
# Country Club Creek Watershed

Data Summary Graphs – *E.coli* (Downstream to Upstream by Year)



# Country Club Creek Watershed

## Score Summary – Reach scores for each sample year



# Country Club Creek Watershed

## Benthic Macroinvertebrates – Taxa List, Pollution Tolerance Index & Functional Feeding Group for 2013 Sample Sites (Downstream to Upstream)

Benthic Macroinvertebrate ID	PTI	FFG	West Country Club @ Crossing Place (Site 849)	West Country Club @ E Oltorf (Site 850)
<i>Erpetogomphus</i> sp.	1	P		1
<i>Chimarra</i> sp.	2	FC		2
<i>Helicopsyche</i> sp.	2	SC		1
<i>Hydroptila</i> sp.	2	SC,PI		1
<i>Callibaetis</i> sp.	4	CG	3	
<i>Fallceon quilleri</i>	4	SC,CG		196
Ostracoda	4	FC,CG		1
<i>Simulium</i> sp.	4	FC		1
<i>Petrophila</i> sp.	5	SC		1
<i>Argia</i> sp.	6	P		13
<i>Brechmorhoga mendax</i>	6	P		1
<i>Cheumatopsyche</i> sp.	6	FC		6
Chironomidae	6	P,FC	6	53
<i>Corbicula fluminea</i>	6	FC	1	
<i>Enallagma</i> sp.	6	P	2	
<i>Neoporus</i> sp.	6	P	1	
<i>Rhagovelia</i> sp.	6	P		1
<i>Bezzia</i> sp. / <i>Palpomyia</i> sp.	7	P,CG		1
<i>Caenis</i> sp.	7	SC,CG	3	2
Culicidae	8	FC	10	
<i>Cymbiodyta</i> sp.	8	P	1	
<i>Daphnia</i> sp.	8	FC	7	
<i>Hyalella</i> sp.	8	SH,CG	67	6
Oligochaeta	8	CG		15
<i>Physella</i> sp.	9	SC		2
Sciomyzidae	10	P	1	
<i>Trepobates</i> sp.	10	P	21	
Cambaridae		CG		2
<i>Dugesia</i> sp.		P,CG		50

# Country Club Creek Watershed

## Benthic Macroinvertebrates – Metric Summary for 2013 Sample Sites (Downstream to Upstream)

Scoring Metric	West Country Club @ Crossing Place (Site 849)	West Country Club @ E Oltorf (Site 850)
Number of Taxa *	11	20
Hilsenhoff Biotic Index *	8.1	4.8
Number of Ephemeroptera Taxa *	2	2
Percent of Total as Chironomidae *	5	15
Number of EPT Taxa *	2	6
Percent of Total as EPT *	5	58
Percent of Total as Predator *	26	34
Number of Intolerant Taxa *	1	7
Percent Dominance (Top 3 Taxa) *	80	84
EPT / EPT + Chironomidae	1	1
Number of Diptera Taxa	3	3
Number of Non-Insect Taxa	2	6
Number of Organisms	122	356
Percent Dominance (Top 1 Taxa)	55	55
Percent of Total as Collector / Gatherer	60	77
Percent of Total as Dominant Guild (FFG)	60	77
Percent of Total as Elmidae	0	0
Percent of Total as Filterers	19	18
Percent of Total as Grazers (PI & SC)	2	57
Percent of Total as Tolerant Organisms	18	1
Percent of Trichoptera as Hydropsychidae	0	60
Ratio of Intolerant : Tolerant Organisms	0.02	2.04
TCEQ Qualitative Aquatic Life Use Score	17	23
TCEQ Quantitative Aquatic Life Use Score	19	29

\* **EII scoring parameter: Nine metric parameters are used in the calculation of the EII Benthic Subindex score. Other metrics are shown to supplement evaluation.**

1. # of Taxa: Higher diversity (number of taxa) correlates with greater biological integrity. The average number of taxa per site for 2013/2014 samples was 15; the lowest value was 5 and the highest value was 30.
2. Hilsenhoff Biotic Index (HBI): HBI values range from 0 to 10. Low HBI values reflect a higher abundance of taxa that are sensitive to organic (nutrient) pollution, thus a lower level of this type of pollution. The average HBI per site for 2013/2014 samples was 5.4; the lowest value was 3.7 and the highest value was 8.1.
3. # of Ephemeroptera taxa: A higher number of Ephemeroptera (mayfly) taxa correlates with greater biological integrity. The average number of taxa per site for 2013/2014 samples was 2; the lowest value was 0 and the highest value was 7.
4. % of total as Chironomidae: The percentage of the sample represented by the Dipteran family Chironomidae will increase with a decrease in biological integrity. The average percent Chironomidae per site for 2013/2014 samples was 16%; the lowest value was 0% and the highest value was 77%.
5. # of EPT Taxa: A higher number of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa correlates with greater biological integrity. The average number of EPT taxa per site for 2013/2014 samples was 4; the lowest value was 0 and the highest value was 12.
6. % of total as EPT: The percentage of the sample represented by the insect orders Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) will decrease with a decrease in biological integrity. The average percent EPT taxa per site for 2013/2014 samples was 46%; the lowest value was 0% and the highest value was 89%.
7. % of total as Predator: The percentage of the sample represented by predators is variable with regard to biological integrity. The average percent predator per site for 2013/2014 samples was 31%; the lowest value was 3% and the highest value was 82%.
8. # of Intolerant Taxa: A higher number of pollution intolerant taxa correlates with greater biological integrity. The average number of intolerant taxa per site for 2013/2014 samples was 5; the lowest value was 0 and the highest value was 15.
9. % Dominance (top 3 taxa): The percentage of the sample represented by the three most abundant taxa will increase with a decrease in biological integrity. The average percent of sample dominated by the top three taxa per site for 2013/2014 samples was 72%; the lowest value was 39% and the highest value was 96%.

# Country Club Creek Watershed

## Diatoms – Taxa List & Pollution Tolerance Index for 2013 Sample Sites (Downstream to Upstream)

Diatom Species Name	PTI	West Country Club @ Crossing Place (Site 849)	West Country Club @ E Oltorf (Site 850)
<i>Amphora inariensis</i>	4	70	1
<i>Diploneis oblongella</i>	4	2	
<i>Achnanthes exigua</i>	3	1	
<i>Achnantheidium minutissimum</i>	3	6	
<i>Amphora libyca</i>	3	6	2
<i>Amphora pediculus</i>	3	130	
<i>Caloneis bacillum</i>	3	4	10
<i>Caloneis ventricosa</i>	3		2
<i>Cocconeis pediculus</i>	3	1	2
<i>Cymatopleura elliptica</i>	3	1	
<i>Denticula kuetzingii</i>	3	12	2
<i>Encyonema silesiacum</i>	3	2	1
<i>Fragilaria capucina</i>	3	3	2
<i>Gomphonema acuminatum</i>	3		6
<i>Gomphonema affine</i>	3		100
<i>Gomphonema gracile</i>	3		3
<i>Gomphonema truncatum</i>	3		24
<i>Halamphora montana</i>	3	2	
<i>Navicula cryptotenella</i>	3	5	
<i>Navicula kotschy</i>	3	6	
<i>Navicula rhynchocephala</i>	3	2	
<i>Nitzschia dissipata</i>	3	16	
<i>Nitzschia nana</i>	3	1	
<i>Placoneis gastrum</i>	3	2	1
<i>Reimeria sinuata</i>	3	10	159
<i>Rhoicosphenia abbreviata</i>	3	2	72
<i>Rhopalodia gibba</i>	3		1
<i>Tabularia fasciculata</i>	3		3
<i>Achnantheiopsis lanceolata</i>	2	10	2
<i>Bacillaria paradoxa</i>	2	1	
<i>Encyonema minutum</i>	2	2	
<i>Eolimna subminuscula</i>	2	1	
<i>Navicula atomus</i>	2	1	
<i>Navicula ingenua</i>	2	6	
<i>Navicula recens</i>	2	1	
<i>Navicula symmetrica</i>	2	1	
<i>Navicula tenelloides</i>	2	4	
<i>Nitzschia amphibia</i>	2	73	11
<i>Nitzschia inconspicua</i>	2	42	
<i>Sellaphora pupula</i>	2	2	
<i>Synedra ulna</i>	2		70
<i>Tryblionella apiculata</i>	2	5	
<i>Gomphonema parvulum</i>	1	6	9
<i>Nitzschia palea</i>	1	2	
<i>Sellaphora seminulum</i>	1	8	
<i>Cocconeis placentula</i> var. <i>lineata</i>		5	17
<i>Denticula tenuis</i>		1	
<i>Eolimna minima</i>		30	
<i>Navicula antonii</i>		8	
<i>Tryblionella debilis</i>		7	

# Country Club Creek Watershed

## Diatoms – Metric Summary for 2013 Sample Sites (Downstream to Upstream)

Scoring Metric	West Country Club @ Crossing Place (Site 849)	West Country Club @ E Oltorf (Site 850)
<i>Cymbella</i> Richness	3	2
Number of organisms	500	500
Number of taxa	42	22
Percent motile taxa	38	2
Percent similarity to reference condition	26	16
Pollution tolerance index	2.76	2.79

\* **EII scoring parameter: Four metric parameters are used in the calculation of the EII Diatom Subindex score: *Cymbella* richness, percent motile taxa, percent similarity to reference condition and pollution tolerance index. Number of taxa is non-scoring, but is shown to supplement evaluation. The number of organisms is typically a sample of 500, but occasionally differs due to sample conditions.**

1. *Cymbella* Richness: The Cymbelloid taxa include species in the genus *Cymbella*, in addition to some species belonging to the genera *Cymbellopsis*, *Cymbopleura*, *Encyonema*, *Encyonemopsis*, *Navicymbula* and *Reimeria*. Their presence highlights the presence of sensitive species, especially with regard to impervious cover, and this value increases with an increase in overall water quality. The average number of Cymbelloid taxa per site for 2013/2014 samples was 3; the lowest value was 0 and the highest value was 7.
2. % Motile Taxa: This is a siltation index showing the relative abundance of genera that are able to move towards the surface if covered by silt. A higher percentage is indicative of a degraded condition caused by increased silt pollution. The average percent motile taxa per site for 2013/2014 samples was 16%; the lowest value was 0% and the highest value was 77%.
3. % similarity to reference condition: This percentage compares a site to reference sites that are selected based on having low percent impervious cover. A higher percentage reflects greater biological integrity. The average percent similarity per site for 2013/2014 samples was 31%; the lowest value was 6% and the highest value was 57%.
4. Pollution Tolerance Index (PTI): This is a total value for a sample, which is a function of the abundance of each taxon (usually species) in a sample and the individual PTI's for each of those taxa. Individual PTI's for each taxon range from 1 (most pollution tolerant) to 4 (most pollution sensitive), thus higher total PTI's for a site reflect greater biological integrity. The average PTI per site for 2013/2014 samples was 2.76; the lowest value was 1.70 and the highest value was 3.45.

# Country Club Creek Watershed

## Site Photographs



1475\_t00-us-07\_06\_2006



1475-t00-us-05-29-2009



848\_t00-ds-12\_14\_2000



848\_t00-us-12\_14\_2000



848\_t00-ds-03\_13\_2003



848\_t00-us-03\_13\_2003

# Country Club Creek Watershed

## Site Photographs



849\_t00-ds-02\_16\_2001



849\_t00-us-02\_16\_2001



850\_t00-us-12\_14\_2000



850-t00-ur-06-01-2009



1474\_t00-us-07\_06\_2006



1474-t00-us-05-29-2009

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